

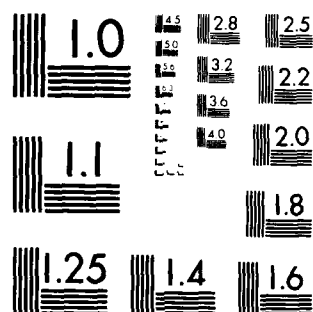
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**DOD THEATER NUCLEAR FORCES  
SURVIVABILITY AND SECURITY (TNFS<sup>2</sup>):  
COMPENDIUM OF ASSESSMENTS RELATED  
TO TNFS<sup>2</sup>C<sup>3</sup> PROGRAM**

**Volume I**

The BDM Corporation  
7915 Jones Branch Drive  
McLean, Virginia 22102

31 December 1979

Topical Report for Period 27 November 1978—31 December 1979

CONTRACT No. DNA 001-79-C-0090

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER DNA 5040T-1	2. GOVT ACCESSION NO. AD-A083 328	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) DOD THEATER NUCLEAR FORCES SURVIVABILITY AND SECURITY (TNFS <sup>2</sup> ): COMPENDIUM OF ASSESSMENTS RELATED TO TNFS <sup>2</sup> C <sup>3</sup> PROGRAM, Volume I		5. TYPE OF REPORT & PERIOD COVERED Topical Report for Period 27 Nov 78—31 Dec 79
7. AUTHOR(s) R.J. Carlin      D.T. Poe      C.E. Campbell J.G. Wilson      W.G. Hwang      R.T. MacOnie T.A. Julian      A.L. Reese      W.E. Sweeney P.H. Dittmer		6. PERFORMING ORG. REPORT NUMBER BDM/W-205-79-TR. (Rev)
9. PERFORMING ORGANIZATION NAME AND ADDRESS The BDM Corporation 7915 Jones Branch Drive McLean, Virginia 22102		8. CONTRACT OR GRANT NUMBER(s) DNA 001-79-C-0090
11. CONTROLLING OFFICE NAME AND ADDRESS Director Defense Nuclear Agency Washington, D.C. 20305		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Subtask A99QAXFA106-02
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 31 December 1979
		13. NUMBER OF PAGES 30
		15. SECURITY CLASS (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This work sponsored by the Defense Nuclear Agency under RDT&E RMSS Code B390079465 A99QAXFA10602 H2590D.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Communications and Radio Systems      Survival General Command and Control Systems      Nuclear Forces Tactical Communications      Security Nuclear Weapons      Theater Nuclear Forces		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This volume describes the TNFS <sup>2</sup> C <sup>3</sup> Compendium and indices and indicates how individual documents in the Compendium relate to specific TNFS <sup>2</sup> C <sup>3</sup> issues.		

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## PREFACE

This compendium of related command, control and communications (C<sup>3</sup>) assessments has been developed to assist the DNA TNF S<sup>2</sup> C<sup>3</sup> Program Manager in the formulation of policy choices for higher level decision. Each program, assessment and related document identified in the compendium has been analyzed and correlated with the tentatively identified specific C<sup>3</sup> issues wherever possible. The results of the analysis and correlation effort have been structured in a format designed to optimize the utility of the data.

Three attributes of each assessment/document have been highlighted:

- (1) Date of publication of effort (where appropriate). This provides a sense of the technological framework within which each assessment/document was completed.
- (2) Numerical indication of impact. This empirically-derived judgement provides a measure of the significance of each assessment/document to the TNF S<sup>2</sup> C<sup>3</sup> Program. The judgement has been based on extensive work in the TNF C<sup>3</sup> area and comparisons of the compendium programs/assessments/documents with each other and with the objectives of the TNF S<sup>2</sup> C<sup>3</sup> Program.
- (3) Applicability to the seven tentatively identified specific TNF C<sup>3</sup> issues. These issues include: U.S. Custodial Communications, Interoperable US/NATO Secure Voice, Jam Resistant Communications, OPSEC, Physical Survivability and Security, Satellite Communications, and Restoral/Reconstitution.

Certain assessments or related documents because of their scope and/or objectives have been listed as "Requirements Studies" or "Bibliographies".

The information on each compendium entry will provide the Program Manager with the means to consider both whether and how best to consider the results of a particular assessment or related document in formulating the desired policy choices. The envisioned structure for such formulation

deliberately focuses upon the Program Manager as the key agent in the process because of the perceived need for a single authority having a comprehensive knowledge of  $C^3$  requirements and the issues arising from them.

There are a significant number of currently on-going or projected study efforts or programs the results of which may impact on the objectives and direction of the TNF  $S^2 C^3$  Program. These efforts include some of the more comprehensive approaches such as the ACE Requirements Study, the NICS II Architecture work, and the activities of the USEUCOM Nuclear Communications Task Force. In addition, a number of potentially relevant more specific tactical  $C^3$  improvement/upgrade programs are in various stages of development or implementation. These include:

- (1) Joint Tactical Communications Program (TRI-TAC)
- (2) Joint Multichannel Trunking and Switching System (JMTSS)
- (3) Jam Resistant Secure Communications (JRSC)
- (4) Position Location Reporting System (PLRS)
- (5) U.S. Army Theater Nuclear Force Survivability (TNF S)
- (6) Integrated Tactical Communications System (INTACS)
- (7) Joint Tactical Information Distribution System (JTIDS)
- (8) SELREL Improvement Program (SELRIP)
- (9) Deployable WWMCCS  $C^3$  Capability (DWC<sup>4</sup>)
- (10) U.S. Army Theater Communications System (TCS)
- (11) Communications Support Requirements - Echelons Above Corps (COMSREAC-85)

In most cases, it is too early to positively identify or predict the impact of the various on-going programs on the TNF  $S^2 C^3$  Program. However, all of the above programs merit continuing close monitoring by the TNF  $S^2 C^3$  Program Manager to identify possible correlation of their efforts and results with the TNF  $S^2 C^3$  Program. In those cases where a direct applicability to TNF  $S^2 C^3$  Program objectives has been identified, information on the relevant program has been included in the compendium. Similarly, where reports or other documents have been produced under such programs (and it has been determined that these reports/documents have

potential applicability to the TNF S<sup>2</sup> C<sup>3</sup> Program) the specific reports/ documents have been included in the TNF S<sup>2</sup> C<sup>3</sup> compendium.

As additional program results become available and applicability to the TNF S<sup>2</sup> C<sup>3</sup> Program becomes better defined, each of the on-going programs should be reexamined to determine:

- (1) How their results can be most effectively integrated into the TNF S<sup>2</sup> C<sup>3</sup> Program effort; and
- (2) What, if any, steps might be taken to avoid duplication of effort and better integrate the separate program activities with the TNF S<sup>2</sup> C<sup>3</sup> Program.

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## SECTION 1

### INTRODUCTION AND ORGANIZATION

#### 1.1 PURPOSE AND SCOPE

The DOD TNF S<sup>2</sup> Program has been undertaken by the Defense Nuclear Agency to enhance theater nuclear force effectiveness through improved survivability and security. The command, control and communications (C<sup>3</sup>) issues of TNF S<sup>2</sup> focus on a variety of operational entities, command and support functions, political and military requirements, and supporting communications systems. The specific supporting roles and the communications requirements vary with the operational circumstances and the perceived threat.

The objective of the TNF S<sup>2</sup> C<sup>3</sup> Program is to enhance TNF effectiveness through near term and long term improvements in the survivability and security of those US national, non-US national, and NATO command, control and communications systems and procedures which support the theater nuclear force. Specifically, the program provides for an in-depth examination of the survivability and security aspects of those C<sup>3</sup> systems and procedures associated with the deployment, maintenance and employment of theater nuclear forces. The basic concept and overall approach of the TNF S<sup>2</sup> C<sup>3</sup> Program provides for early identification of issues and the testing of potential technological and procedural improvements.

This particular report has as its purpose the identification and analysis of relevant C<sup>3</sup> programs and assessments conducted outside the TNF S<sup>2</sup> C<sup>3</sup> Program in order to determine their applicability to TNF S<sup>2</sup> C<sup>3</sup> Program objectives. The study is comprised of two parts:

- (1) Identification of TNF C<sup>3</sup> programs and assessments, and
- (2) Analysis and correlation of the identified assessments to the TNF S<sup>2</sup> C<sup>3</sup> Program.

Each report or document which has been identified has been evaluated in terms of:

- (1) How it may impact on the TNF S<sup>2</sup> C<sup>3</sup> Program;
- (2) The significance of its contents with respect to TNF S<sup>2</sup> C<sup>3</sup> Program objectives and issues; and

- (3) How relevant results of past, ongoing, or future assessments may be integrated into the TNF S<sup>2</sup> C<sup>3</sup> Program.

This volume contains the results of the evaluation process described above. The compendium listing the relevant C<sup>3</sup> program/assessments and related documents is published separately as an Appendix to this report to facilitate its intergration with the existing TNF S<sup>2</sup> Compendium.

#### 1.2 ORGANIZATION OF THE COMPENDIUM

Each assessment and document which has been identified and included in this compendium has been described in terms of: its bibliographical information, a TNF S<sup>2</sup> Related Compendium code letter and C<sup>3</sup> code number, and an abstract of the document.

##### 1.2.1 Bibliographical Information

Each entry in this compendium should contain the following bibliographical information:

- (1) Title of Document,
- (2) Contractor/Agency Author and Location,
- (3) Technical Report Number (or Access/Log Number),
- (4) Contracting Agency and Location,
- (5) Contract Number,
- (6) Date of Document,
- (7) Classification of Document,
- (8) AD Number (if DDC document) and
- (9) Distribution (Limited, etc.)

In some cases an entry may not contain all of the aforementioned bibliographical data because complete information was not available or because the project is ongoing. These entries were retained in the survey to keep the compendium as comprehensive as possible. The missing data will be compiled as it becomes available and will be included in future revisions of this document. Figure 1 depicts a sample worksheet format that can be reproduced for the purpose of submitting additions to the TNF S<sup>2</sup> Related Compendium.

Title of Document:
Contractor/Agency Author and Location:
Technical Report No. (or Access/Log No.):
Contracting Agency and Location:
Contract No.:
Date of Document:
Classification of Document:
AD No. (If DDC Document):
Distribution:

CODE:

SUMMARY:

1120/70W

Figure 1. TNF S<sup>2</sup> related compendium format.

### 1.2.2 TNF S<sup>2</sup> Related Compendium Code Letter

The TNF S<sup>2</sup> Related Compendium Code Letter indicates the various TNF S<sup>2</sup> C<sup>3</sup> Program areas a particular source addresses. The TNF S<sup>2</sup> Related Compendium categorizes data sources according to their relationship(s) to the following areas of overall program concern:

(1) Threat,	CODE LETTER:	A
(2) C <sup>3</sup> ,		B
(3) Security,		C
(4) Survivability,		D
(5) Theater Nuclear Force,		E
(6) Simulations and Models,		F
(7) Testing, and		G
(8) Miscellaneous.		H

### 1.2.3 TNF S<sup>2</sup> C<sup>3</sup> Code Number

All of the programs and documents included in the TNF S<sup>2</sup> C<sup>3</sup> Program compendium (Appendix B) have been identified with a TNF S<sup>2</sup> Related Compendium Code Letter "B" indicating a relationship to the general C<sup>3</sup> area. Where appropriate, additional general TNF S<sup>2</sup> areas have also been identified.

To further assist the reviewer in identifying the information available in a particular report or document source, each entry in Appendix B has been assigned a C<sup>3</sup> code number in addition to the code letter "B". The C<sup>3</sup> code number indicates a relationship within the general C<sup>3</sup> area to one or more of the following more specific areas of TNF S<sup>2</sup> C<sup>3</sup> Program concern:

(1) Threat to C <sup>3</sup>	CODE NUMBER:	1
(2) Security of C <sup>3</sup> facilities		2
(3) Survivability of C <sup>3</sup> facilities		3
(4) C <sup>3</sup> Requirements		4
(5) C <sup>3</sup> Modeling and Simulation		5
(6) C <sup>3</sup> Testing		6

Therefore, a B.5 code entry in Appendix B, for example, would indicate that the entry relates to the general C<sup>3</sup> area and in particular to

the modeling and simulation of  $C^3$  systems or networks. Similarly, a B.3.4 entry would indicate a particular relationship to survivability issues for  $C^3$  facilities as well as  $C^3$  requirements.

The scope of the related area indicated by each of the TNF  $S^2 C^3$  code numbers is as follows:

- (1) Threat to  $C^3$ . (Code number 1) This area encompasses consideration of the complete spectrum of threats to  $C^3$  systems and procedures including sabotage, terrorist actions, electronic warfare (including direction finding and jamming), COMSEC and OPSEC procedures, conventional attack and nuclear weapons effects.
- (2) Security of  $C^3$  facilities. (Code number 2) This area includes consideration of vulnerabilities and corrective actions which would impact on the security of  $C^3$  facilities and which could have an impact on the overall effectiveness of the theater nuclear force. It includes considerations of protective measures to enhance security (such as provision of improved alarm systems or reinforced guard forces).
- (3) Survivability of  $C^3$  facilities. (Code number 3) This area includes consideration of vulnerabilities and corrective actions which would impact on the survivability of  $C^3$  facilities and which could have an impact on the overall effectiveness of the theater nuclear force. It includes consideration of such measures as increased hardening and the use of multiple paths and interlocking networks.
- (4)  $C^3$  Requirements. (Code number 4) This area includes consideration of  $C^3$  facilities, systems and procedures required to support the four primary functions of the TNF: Deployment; Employment; Storage, Maintenance and Security; and Readiness and Reliability. It includes establishment and analysis of information need lines and communications connectivity requirements.
- (5)  $C^3$  Modeling and Simulation. (Code number 5) This area includes consideration of modeling and simulation activities conducted to assess the capabilities and limitations of the  $C^3$  systems, networks, and procedures which support the TNF. It includes digital

and hybrid simulations designed to represent  $C^3$  equipment or systems under realistic conditions.

- (6)  $C^3$  Testing. (Code number 6) This area includes consideration of the results of  $C^3$  test programs which could have an impact on the objectives of the TNF  $S^2 C^3$  Program. It includes both direct and indirect test results.

#### 1.2.4 Document Abstract

The third part of each entry consists of an abstract of the document which indicates the scope and type of information contained within the data source and, where appropriate, a summary of key results.

#### 1.3 ORGANIZATION OF THE INDEX

Two indices are provided for the user's convenience. The first index is an alphabetical arrangement of the program/document titles with appropriate code entries and page numbers. The second index is a chronological arrangement of the program/document titles with the most recent (or on-going or projected) program/documents being listed first. Again, the appropriate code entries and page numbers are provided. These indices are located in Appendix A and B, respectively, in Volume II.



SECTION 2  
THE RELATIONSHIP OF THE COMPENDIUM TO THE  
TNF S<sup>2</sup> C<sup>3</sup> PROGRAM

2.1 INDIVIDUAL PROGRAM/DOCUMENT RELATIONSHIPS

Table 1 depicts graphically the relationship and relevance of each document included in the compendium to the TNFS<sup>2</sup> C<sup>3</sup> Program. The potential impact and significance of the results of a specific assessment or related document are represented by a numerical value on a scale of 1 to 10 in the "Impact/Significance" column. The larger the number, the greater the relevance to the TNFS<sup>2</sup> C<sup>3</sup> Program. The impact/significance number also reflects the age of the information. For example, a designation of five indicates an assessment or related document containing old but still useful data. Numbers above this level reflect increasing utility both in terms of how recently the assessment was completed (if not currently on-going or planned) and in the degree of detail and scope of the pertinent information. Numbers between 1 and 4 generally indicate older assessments which contain data which may be useful primarily in the development of a current baseline including capabilities and deficiencies.

2.2 GENERAL RELATIONSHIPS AMONG PROGRAMS/DOCUMENTS

The entries in the "Specific Issues" columns in the table are related to the previous technical report in this series. The "Specific Issues" entry indicates relevance to the specific C<sup>3</sup> issues which have been tentatively identified. The "Index" column refers the reader to the appropriate page of the compendium. The indication that a particular document addresses one or more specific TNF S<sup>2</sup> C<sup>3</sup> issues does not indicate that either the scope or detail of the relevant discussion in that document meets some predetermined standard. Consequently, there may be marked differences among a group of documents in the amount of information each contains on a given issue which the table indicates each document addresses in common with several others in that group.

Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues.

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT/SIGNIFICANCE	SPECIFIC ISSUES					
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	ORSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS
MINUTES, DNA PROGRAM, 2ND INCA COORDINATION MEETING	B-2.89	2	●	●				●
INTEGRATED TACTICAL COMMUNICATIONS SYSTEM, TASK IV, REFINED ALTERNATIVE MRTF COMMUNICATIONS CONCEPTS	B-2.81	2						
AN OVERVIEW OF HF COMMUNICATIONS IN A NUCLEAR ENVIRONMENT	B-2.88	5	●				●	
NUCLEAR VULNERABILITY ASSESSMENT OF TACTICAL SHIPBOARD ELECTRONIC SYSTEMS	B-2.56	5						
ANALYSIS OF THE 1985 TACTICAL NUCLEAR LAND BATTLE	B-2.48	4		(REQUIREMENTS STUDY)				
U.S. BLUE RIDGE (LCC19) COMMUNICATIONS EFFECTIVENESS EVALUATION	B-2.52	3						
INTRODUCTION TO NUCLEAR WEAPONS EFFECTS ON NAVAL HIGH FREQUENCY COMMUNICATIONS SYSTEMS	B-2.58	2	●					
TACTICAL SATELLITE COMMUNICATIONS COST EFFECTIVENESS ANALYSIS STUDY (TACSATCOM), VOLUME III, APPENDIX G, THREAT TO U.S. ARMY COMMUNICATIONS	B-2.24	5					●	
COMMUNICATIONS ELECTRONICS-75 (CE-75), PHASE I, FIELD ARMY, VOLUME 4, ANNEX E COMMUNICATIONS SYSTEMS CONCEPTS	B-2.22	4					●	
INTEGRATED NUCLEAR COMMUNICATIONS ASSESSMENT, PHASE I REPORT	B-2.31	5					●	
NAVAL TELECOMMUNICATIONS SYSTEM ARCHITECTURE, 1975-1985	B-2.54	5		(REQUIREMENTS STUDY)				
ANALYSIS OF TYPICAL THEATER ARMY COMMUNICATION LINKS IN A NUCLEAR ENVIRONMENT	B-2.85	5					●	
WD WBRNCOM VULNERABILITY AND SURVIVABILITY STUDY, FINAL REPORT	B-2.83	4					●	
MINUTES, DNA INCA PROGRAM, 6TH COORDINATION MEETING	B-2.92	4					●	●
EUROPEAN THEATER NUCLEAR FORCES C <sup>3</sup> SYSTEMS STUDY, FINAL REPORT	B-2.46	5		(REQUIREMENTS STUDY)				
MINUTES, DNA INCA PROGRAM, 5TH COORDINATION MEETING	B-2.86	4					●	●
NAVY TACTICAL NUCLEAR WEAPONS STUDY, VOLUME I	B-2.44	3						
MINUTES, DNA INCA PROGRAM, 4TH COORDINATION MEETING	B-2.91	3	●				●	
MINUTES, DNA INCA PROGRAM, 3RD COORDINATION MEETING	B-2.90	2	●				●	
PROTECTION OF THE NICS AGAINST NUCLEAR EXPLOSION EFFECTS	B-2.23	5					●	

Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO COMMUNICATIONS	JMW SECURE VOICE	JMW RESISTANT COMMUNICATIONS	SPECIFIC ISSUES			
							PHYSICAL SURVIVABILITY	SECURITY	SATELLITE COMMUNICATIONS	RESTORATION / RECONSTITUTION
MINIMUM ESSENTIAL EMERGENCY COMMUNICATIONS NETWORK SYSTEM ENGINEER	B-2.18	5					●			
JOURNAL OF DEFENSE RESEARCH, VOLUME 8, NO. 4	B-2.18	3		●						
IMPROVING THE EFFECTIVENESS OF NATO'S THEATER NUCLEAR FORCE	B-2.38	5					●			
ANALYSIS OF TWO-WAY AND REPORT BACK THEATER COMMUNICATIONS	B-2.71	4					●			
COMPARISON OF SOVIET AND U.S. GROUND FORCE CAPABILITIES IN ELECTRONIC WARFARE, VOLUMES I AND II AND EXECUTIVE BRIEFING	B-2.28	6		●			●			
MINUTES, DNA INCA PROGRAM, 8TH COORDINATION MEETING	B-2.83	4					●			
EUROPEAN COMMAND, CONTROL, AND COMMUNICATIONS STUDY GROUP, FINAL REPORT	B-2.37	5								
NAVY C <sup>3</sup> STUDY	B-2.43	5								
INCA PROPAGATION PATH EFFECTS ASSESSMENT FOR SATELLITE AND TROPOSCATTER COMMUNICATIONS IN THE TACTICAL THEATER	B-2.79	4	●					●		
COLLECTION AND PROCESSING OF INFORMATION PERTINENT TO THE TACTICAL NUCLEAR BATTLEFIELD	B-2.21	5								
IMPACT OF SABOTAGE ON DCS FACILITIES, PHASE I	B-2.15	6					●			
IMPACT OF SABOTAGE ON MANNED DCS FACILITIES, TASK 1, SURVEY AND ANALYSIS	B-2.13	8					●			
IMPACT OF SABOTAGE IN MANNED DCS FACILITIES, TASK 2, COST BENEFITS ANALYSIS	B-2.5	8					●			
MULTIPLE SYSTEMS EVALUATION PROGRAM, FINAL REPORT ON CRITICAL COMMUNICATIONS FOR TACTICAL NUCLEAR DELIVERY SYSTEMS	B-2.16	5		(REQUIREMENTS STUDY)						
ASSESSMENT OF NCA-TO-THEATER C <sup>3</sup> SYSTEMS	B-2.4	8					●			
SHAPE C <sup>2</sup> SURVIVABILITY SUPPORT PROGRAM	B-2.1	7					●			
BLAST EFFECTS ON US WEAPONS SYSTEMS, VEHICLE SYSTEMS, AND C <sup>3</sup> EQUIPMENT	B-2.3	7					●			
NUCLEAR WEAPONS EFFECTS VULNERABILITY TESTS	B-2.2	8					●			
DEVELOPMENT OF ELECTRONIC VULNERABILITY INFORMATION SOURCES	B-2.9	7					●			

Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	SPECIFIC ISSUES					
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	OPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS RESTORAL / RECONSTITUTION
INVESTIGATION OF THE VULNERABILITY/SURVIVABILITY OF SYSTEMS SUPPORTING THE NCA DECISION PROCESS	0-2.17	0					●	●
NET TECHNICAL ASSESSMENT: IMPACT OF EW ON TARGET KILL ROLES AT U.S. BRIGADE/SOVIET REGIMENTAL LEVEL	0-2.32	5		●	●			
MINUTES, DNA INCA PROGRAM, 10TH COORDINATION MEETING	0-2.95	4						
INTEGRATED TACTICAL INFORMATION SYSTEMS DESIGN STUDY	0-2.80	5	(REQUIREMENTS STUDY)					
ELECTRONIC WARFARE VULNERABILITY OF U.S. ARMY SELECTED OVERSEAS TACTICAL UNITS	0-2.47	0	●	●				
MINUTES, DNA INCA PROGRAM, 9TH COORDINATION MEETING	0-2.94	4					●	
EMP ASSESSMENT FOR ARMY TACTICAL COMMUNICATIONS SYSTEMS: TRANSMISSION SYSTEMS SERIES NO. 1 - RADIO TERMINAL SET AN/TRC-145	0-2.78	4					●	
EMP VULNERABILITY ANALYSIS OF RADIO SETS AN/PRC-77, AN/VRC-94, AND AN/GRC-100	0-2.83	4					●	
ARCHITECTURE FOR TACTICAL SWITCHED COMMUNICATIONS SYSTEMS	0-2.72	7	(REQUIREMENTS STUDY)					
EVALUATION OF SURVIVABILITY/RECOVERABILITY ASPECTS OF THE DCS SYSTEM CONTROL	0-2.82	7						●
IMPACT OF ESM INTELLIGENCE ON CORPS LEVEL COMBAT	0-2.30	5		●				
U.S. FORWARD AIR DEFENSE EW VULNERABILITY	0-2.36	6		●	●			
PROCEEDINGS OF THE TWENTY-SECOND ANNUAL JOINT ELECTRONIC WARFARE CONFERENCE, VOLUME 1	0-2.49	4		●			●	
EUROPEAN DCS SURVIVABILITY ENHANCEMENTS STUDY	0-2.84	7	(REQUIREMENTS STUDY)					
EFFECTIVENESS OF HARDENING SHIPS, VOLUME 1, EXECUTIVE SUMMARY	0-2.50	5						
EFFECTIVENESS OF HARDENING SHIPS, VOLUME 2	0-2.51	0						
U.S. NAVY SATELLITE COMMUNICATIONS VULNERABILITY: INITIAL ASSESSMENT OF THE VULNERABILITY OF SATELLITE COMMUNICATIONS TO INTERCEPT, GEOPOSITIONING, AND EXPLOITATION THROUGH 1980	0-2.20	7					●	
JOINT BATTLEFIELD NUCLEAR OPTION PROCEDURES STUDY	0-2.00	3	●					

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Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	SPECIFIC ISSUES						
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	DPRC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
REQUIREMENTS AND SOLUTIONS FOR COMMUNICATIONS ELEMENT: THEATER NUCLEAR WAR, ANNEX 2	B-2.68	8			(REQUIREMENTS STUDY)				
REQUIREMENTS AND SOLUTIONS FOR COMMAND AIDS ELEMENT: THEATER NUCLEAR WAR, ANNEX 4	B-2.78	8			(REQUIREMENTS STUDY)				
REQUIREMENTS AND SOLUTIONS FOR DATA COLLECTION AND PROCESSING ELEMENT: THEATER NUCLEAR WAR, ANNEX 3	B-2.88	8			(REQUIREMENTS STUDY)				
SOVIET REC THREAT TO TNF, VOLUME II, FINAL REPORT	B-2.96	7		●	●	●			
AFWMCCS PERFORMANCE IN AN EW ENVIRONMENT, PHASE I, FINAL REPORT	B-2.87	7		●		●			
AFCEA SYMPOSIUM "INTERNATIONAL INTEROPERABILITY, COMMUNICATIONS, COMMAND AND CONTROL"	B-2.25	5	●						
JOURNAL OF DEFENSE RESEARCH: TACTICAL C <sup>3</sup>	B-2.88	5					●		
IMPACT OF SELECTED COUNTER C <sup>3</sup> OPERATIONS ON SOVIET TACTICAL MISSION EFFECTIVENESS	B-2.38	5					●		
ANNUAL DEFENSE REPORT FOR FY1979	B-2.26	7							
INITIAL VULNERABILITY ASSESSMENT OF EXISTING AND WICS STAGE 1 COMMUNICATIONS FACILITY	B-2.55	6					●		
COMMAND, CONTROL, AND COMMUNICATIONS FOR U.S. THEATER NUCLEAR FORCES IN PACOM	B-2.122	4							
INFORMATION REQUIREMENTS FOR THE CONVENTIONAL/ NUCLEAR BATTLEFIELD	B-2.123	5			(REQUIREMENTS STUDY)				
DEFENSE SCIENCE BOARD TASK FORCE ON THEATER NUCLEAR FORCES RESEARCH AND DEVELOPMENT REQUIREMENTS	B-2.124	8			(REQUIREMENTS STUDY)				
EUROPEAN THEATER ANALYSIS, APPENDIX A, 1989 SCENARIO, NATO FORCES	B-2.126	8		●					
OPERATIONAL CONCEPTS FOR THE NUCLEAR TOMAHAWK GROUND LAUNCHED CRUISE MISSILE	B-2.126	7			(REQUIREMENTS STUDY)				
FIELD ARTILLERY ORGANIZATION AND SYSTEM REQUIREMENTS, 1981-1986, VOLUME III, 1986 TIME FRAME	B-2.127	6			(REQUIREMENTS STUDY)				
JOINT TEST OF VULNERABILITY OF U.S. TACTICAL DATA LINKS, DESIGN DEFINITION PHASE	B-2.128	7		●					

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Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	SPECIFIC ISSUES						
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	OPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
WWMCCS ARCHITECTURAL ALTERNATIVES FOR THEATER NUCLEAR WAR, SIXTH REPORT, VOLUME I, EXECUTIVE OVERVIEW AND ARCHITECTURAL SUMMARY	B-2.117	7			(REQUIREMENTS STUDY)				
WWMCCS ARCHITECTURAL ALTERNATIVES FOR THEATER NUCLEAR WAR, VOLUME 2, ARCHITECTURAL ALTERNATIVES	B-2.118	7			(REQUIREMENTS STUDY)				
CANDIDATE BROAD ARCHITECTURAL ALTERNATIVES AND DECISION CONSIDERATIONS FOR THE WWMCCS, NINTH REPORT, EXECUTIVE OVERVIEW	B-2.119	7			(REQUIREMENTS STUDY)				
IMPLICATIONS OF TACTICAL BATTLEFIELD SITUATIONS AND SYSTEMS ON THE REQUIREMENTS FOR THE WWMCCS ARCHITECTURE	B-2.120	7			(REQUIREMENTS STUDY)				
WWMCCS ARCHITECTURAL ALTERNATIVES AND DECISION CONSIDERATIONS FOR CRISIS SITUATIONS, EIGHTH REPORT	B-2.121	7			(REQUIREMENTS STUDY)				
IDENTIFICATION OF SOME TOPICS FOR A PROPOSED ARPA TACTICAL WARFARE STUDIES PROGRAM	B-2.123	2			(REQUIREMENTS STUDY)				
SOVIET CAPABILITY TO CONDUCT ELECTRONIC WARFARE AGAINST US SPACE SYSTEMS	B-2.130	6	●		●		●		
ECCM FOR DEFENSE COMMUNICATIONS SYSTEM (DCS)	B-2.142	7							●
WARSAW PACT SIGNAL INTELLIGENCE AND ELECTRONIC WARFARE THREAT TO US GROUND FORCES	B-2.138	5							
SATELLITE COMMUNICATIONS FOR THE GLCM LAUNCH CONTROL CENTER	B-2.137	8					●		
ANTI JAM POLICY STUDY, FINAL REPORT, VOLUME II, ANTI-JAM REQUIREMENTS	B-2.144	8			●				
ECCM FOR DCS	B-2.149	7							●
TASK FORCE 8 COMMUNICATIONS, COMMAND AND CONTROL, FINAL REPORT	B-2.147	8			(REQUIREMENTS STUDY)				
NATO INTEGRATED COMMUNICATIONS SYSTEM STAGE II ARCHITECTURE, VOLUME II (PLUS ANNEXES)	B-2.146	8			(REQUIREMENTS STUDY)				
RATIONALIZATION/STANDARDIZATION WITHIN NATO, FIFTH SECDEF REPORT TO THE CONGRESS	B-2.148	8	●	●			●		
MALLARD 1 VULNERABILITY ANALYSIS	B-2.146	7			●				
INITIAL USE OF JOINT MULTICHANNEL TRUNKING AND SWITCHING SYSTEMS (JMTSS) ANALYSIS (OPLAN 4182)	B-2.82	7			(REQUIREMENTS STUDY)				

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Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	SPECIFIC ISSUES					
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	OPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS
JMTSS MANAGEMENT/IMPLEMENTATION PLAN, SECOND DRAFT	B-2.75	8			(REQUIREMENTS STUDY)			
GROUND MOBILE FORCES SATELLITE COMMUNICATIONS, VOLUME I, OPERATIONAL CONCEPTS	B-2.140	7			(REQUIREMENTS STUDY)			
GROUND MOBILE FORCE SATELLITE COMMUNICATIONS, VOLUME II, CONTROL CONCEPTS	B-2.141	7			(REQUIREMENTS STUDY)			
NUCLEAR COMMUNICATIONS TASK FORCE (NCTAF) REPORT	B-2.143	9			(REQUIREMENTS STUDY)			
OPERATIONAL CONCEPT FOR THE NCTAF PROPOSED COMMUNICATIONS ENHANCEMENTS	B-2.14	9	●	●			●	●
ALLIED COMMAND EUROPE (ACE) NUCLEAR COMMAND & CONTROL IMPROVEMENT PROGRAM	B-2.8	8			(REQUIREMENTS STUDY)			
US EUCON COMMAND AND CONTROL SOLUTIONS	B-2.10	8			(REQUIREMENTS STUDY)			
DEVELOPMENT OF SCOPE FOR IMPROVING THE SURVIVABILITY/SECURITY OF THE THEATER NUCLEAR FORCE	B-2.11	7			(REQUIREMENTS STUDY)			
WWMCCS ARCHITECTURAL PLAN, ELEVENTH REPORT	B-2.12	7			(REQUIREMENTS STUDY)			
TACTICAL COMMAND AND CONTROL SYSTEM INTERCEPT VULNERABILITY ANALYSIS, VOLUME I, INTRODUCTION AND SUMMARY	B-2.133	3						
AN ASSESSMENT OF THE TECHNOLOGY FOR CONTROL OF FORCES AND WEAPONS ON THE BATTLEFIELD, INTERIM REPORT	B-2.134	3						
IMPROVING TACTICAL COMMAND AND CONTROL IN CENTRAL EUROPE	B-2.135	4			(REQUIREMENTS STUDY)			
TO&E OF TAC COMSEC SYSTEM, RED FLAG 77.7	B-2.34	5						
LAUNCH CONTROL CENTER COMMUNICATIONS STUDY	B-2.50	7			(REQUIREMENTS STUDY)			
CENTRALIZED C <sup>3</sup> IN NATO: FORCE MULTIPLIER OR SHORT CIRCUIT?	B-2.130	7						

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Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	SPECIFIC ISSUES						
			US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	DIPSEC	PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
ANALYSIS OF BASELINE TACTICAL C <sup>3</sup> VULNERABILITY IN A NUCLEAR ENVIRONMENT	B-2.53	8		●					
SURVIVABILITY AND EMPLOYMENT OF TACTICAL NUCLEAR AND CONVENTIONAL AIRPOWER IN CENTRAL NATO, PHASE I	B-2.42	4							
NUCLEAR SURVIVABILITY AND VULNERABILITY OF NAVAL C <sup>3</sup> SYSTEMS IN EUROPEAN THEATER OPERATIONS	B-2.46	5							
PACIFIC SATELLITE COMMUNICATIONS EMP SURVIVABILITY	B-2.61	5					●		
TELECOMMUNICATIONS COUNTER-COUNTER MEASURES FOR TACTICAL COMMAND AND CONTROL SYSTEMS	B-2.67	8		●					
NTA: TACTICAL AIR SUPPORT OF U.S. FORWARD AREA GROUND COMMANDERS IN AN EW ENVIRONMENT	B-2.48	5		●					
EMP ASSESSMENT FOR ARMY TACTICAL COMMUNICATIONS SYSTEMS: TRANSMISSION SYSTEMS SERIES NO. 2. RADIO TERMINAL SET AN/TRC-117	B-2.64	6		●		●			
REQUIREMENTS FOR U.S. EUROPEAN C <sup>3</sup> SUPPORT	B-2.74	6			(REQUIREMENTS STUDY)				
EUROPEAN C <sup>3</sup> IMPLEMENTATION STUDY, FINAL REPORT	B-2.38	6			(REQUIREMENTS STUDY)				
ADAPTABLE HF COMMUNICATION SYSTEMS FOR USE IN A NUCLEAR ENVIRONMENT	B-2.110	5	●						●
AIR DEFENSE MATERIEL EMP VULNERABILITY SURVEY OF ARMY TACTICAL SYSTEMS	B-2.57	5				●			
CENTRAL REGION AIR COMMAND AND CONTROL, INFORMATION FLOW ANALYSIS, PART I	B-2.111	5			(REQUIREMENTS STUDY)				
CENTRAL REGION AIR COMMAND AND CONTROL, VOLUME II	B-2.112	7			(REQUIREMENTS STUDY)				
SECURITY AND SURVIVABILITY OF THEATER NUCLEAR WEAPONS LOGISTICAL SUPPORT CAPABILITIES, DRAFT FINAL REPORT	B-2.113	7				●			
A DISCUSSION OF ISSUES OF TACTICAL NUCLEAR WARFARE	B-2.114	3			(REQUIREMENTS STUDY)				
TNF S <sup>2</sup> COMMUNICATIONS PROGRAM MANAGEMENT PLAN	B-2.115	7			(REQUIREMENTS STUDY)				
BIBLIOGRAPHY OF NSA REPORTS ON TACTICAL PROGRAM	B-2.116	6			(BIBLIOGRAPHY)				

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Table 1. Relationship of individual programs/ documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO COMMUNICATIONS	JAM RESISTANT COMMUNICATIONS	DIPSEC	SPECIFIC ISSUES		
							PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
NUCLEAR SURVIVABLE C <sup>2</sup> SYSTEM	B-2.7	8					●		
ASSESSMENT OF THE IMPACT OF SURVEILLANCE AND ELECTRONIC WARFARE SYSTEMS ON COMBAT OPERATIONS	B-2.8	8					●		
AFWMCCS EW, PHASE II, FINAL REPORT	B-2.87	7		●					
SOVIET GROUND FORCES COMMAND, CONTROL, AND COMMUNICATIONS SYSTEMS AT THE TACTICAL LEVEL	B-2.77	7							
COMMAND, CONTROL AND COMMUNICATIONS FOR US-NATO THEATER NUCLEAR FORCES	B-2.86	3	●						
EW VULNERABILITY AND CONSEC POSTURE OF C <sup>3</sup> OF PERSHING SYSTEM	B-2.73	8			●				
ASSESSMENT AND MODELS OF MOBILE COMMAND POST SURVIVABILITY IN A TACTICAL NUCLEAR ENVIRONMENT, DRAFT FINAL REPORT	B-2.29	6					●		
REPRESENTATIVE COMMAND POST CONFIGURATIONS C <sup>3</sup> STRUCTURES AND REFERENCE DATA, VOLUME I	B-2.41	6							
IN-LA PHASE I: STUDY OF THE EFFECT OF A TACTICAL NUCLEAR ENVIRONMENT ON THE PERFORMANCE OF EM SYSTEMS	B-2.76	4	●	●			●		
NUCLEAR DOCTRINE, ORGANIZATION AND EQUIPMENT (NUODRE) COMMAND AND CONTROL STUDY	B-2.27	3							
COMMUNICATIONS AND TARGET ACQUISITION CONCEPTS IN TACTICAL NUCLEAR WARFARE	B-2.98	3					●		
TACTICAL RADIO COMMUNICATION SYSTEM CONCEPT STUDY	B-2.99	3							
AIR FORCE TACTICAL FORCES 1986 STUDY, VOLUME IX, COMMAND, CONTROL AND COMMUNICATIONS MISSION REQUIREMENTS	B-2.100	2							
TACTICAL AWACS MEASURES OF EFFECTIVENESS	B-2.101	3							
THEATER NUCLEAR C <sup>3</sup> , VOLUME I, FINAL REPORT	B-2.102	6	●		●	●	●		
THEATER NUCLEAR C <sup>3</sup> , VOLUME II, APPENDICES	B-2.103	6			●	●	●		
FACTORS INVOLVED IN BATTLEFIELD ELECTROMAGNETIC COVER AND DECEPTION (BELCAD), VOLUMES I AND II (APPENDICES)	B-2.104	5		●					

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Table 1. Relationship of individual programs/documents to  
TNF S<sup>2</sup>C<sup>3</sup> issues. (Continued)

PROGRAM / DOCUMENT TITLE	INDEX	IMPACT / SIGNIFICANCE	US CUSTODIAL COMMUNICATIONS	INTEROPERABLE US-NATO SECURE VOICE	JAM RESISTANT COMMUNICATIONS	DPSEC	SPECIFIC ISSUES		
							PHYSICAL SURVIVABILITY AND SECURITY	SATELLITE COMMUNICATIONS	RESTORAL / RECONSTITUTION
TITLE AND ABSTRACTS OF TECHNICAL REPORTS, TECHNICAL MEMORANDA, AND PROFESSIONAL PAPERS PUBLISHED BY THE SHAPE TECHNICAL CENTER	B-2.105	5			(BIBLIOGRAPHY)				
JRSC EXECUTING COMMANDERS TERMINAL SYSTEM/ SUBSYSTEM ANALYSIS	B-2.106	6			(REQUIREMENTS STUDY)				
AIR FORCE TACTICAL FORCES 1985 STUDY, VOLUME IX, COMMAND, CONTROL AND COMMUNICATIONS MISSION REQUIREMENTS (ANNEXES)	B-2.107	2			(REQUIREMENTS STUDY)				
REPORT TO NATO C <sup>3</sup> INITIATIVES TASK FORCE ON C <sup>3</sup> NUCLEAR SURVIVABILITY ISSUES	B-2.108	6				●			
PRELIMINARY THEATER C <sup>3</sup> NUCLEAR SURVIVABILITY ASSESSMENT	B-2.109	4				●			
THEATER NUCLEAR PROGRAMS SYNTHESIS, VOLUME I, SYNTHESIS REPORT	B-2.129	7			(REQUIREMENTS STUDY)				
THEATER NUCLEAR PROGRAMS SYNTHESIS, VOLUME II, STUDY SUMMARIES	B-2.131	7			(REQUIREMENTS STUDY)				
OPERATIONAL CONCEPT FOR THE TOMAHAWK GROUND LAUNCHED CRUISE MISSILE	B-2.132	6			(REQUIREMENTS STUDY)				
ANALYSIS OF THE SURVIVABILITY AND VULNERABILITY OF E-3A IN CENTRAL EUROPE	B-2.130	5				●			

### 2.3 DISTRIBUTION OF PREVIOUS EFFORT

Figure 2 depicts graphically the number of compendium entries which contain information pertinent to each of the tentatively identified TNF S<sup>2</sup> C<sup>3</sup> specific issues. A separate bar portraying the number of more comprehensive assessments of the TNF S<sup>2</sup> C<sup>3</sup>--those identified as Requirements Studies in the Compendium--is also shown for purposes of comparison. This information indicates the relative weight of effort previously allocated to the study and evaluation of questions which are directly related to the specific C<sup>3</sup> issues. Figure 2 also indicates which specific issues are candidates for further work and which are less candidates for further study and evaluation than for integration with other work done previously. For example, only three programs/documents in the compendium directly address the specific issue of Interoperable US-NATO Secure Voice. On the other hand, 46 programs/documents deal with the specific issue of Physical Survivability and Security. This suggests that specific Interoperability issues may be candidates for further assessment before recommendations on possible new programs, if needed, can be formulated. By comparison, all that may need to be done in the area of the Physical Survivability and Security issue is to evaluate and coordinate previous programs to ensure that they have been assigned proper priority and adequate funding. While the potential utility to the TNF S<sup>2</sup> C<sup>3</sup> Program Manager of such comparisons is obvious, he will have to examine each candidate for further assessment carefully on its own merits since those assessments that have been conducted in a relatively little studied issue area may well be so recent, comprehensive in treatment, or of such excellence as to preclude the need for additional work. It must also be remembered, as indicated previously, that the amount of information contained in different compendium entries which deal with a particular specific issue may vary markedly.

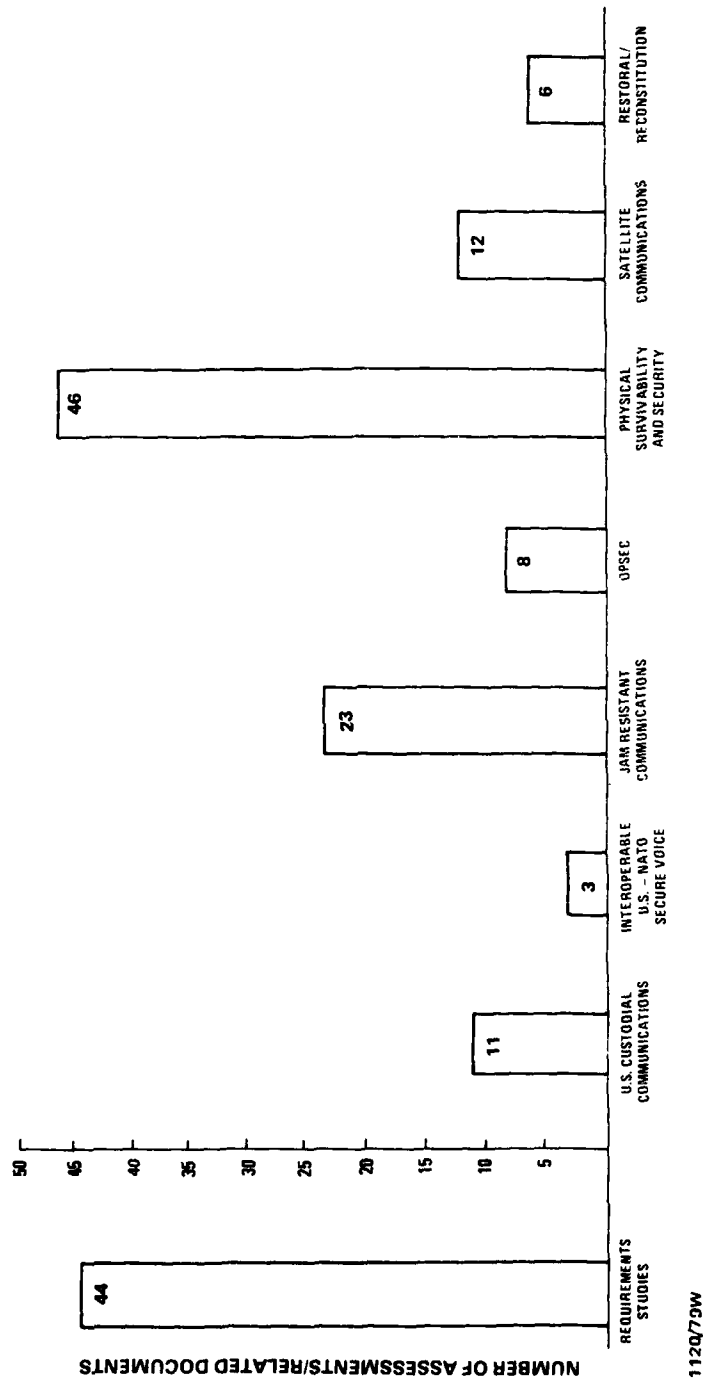


Figure 2. Number of assessments addressing each specific TNF S<sup>2</sup>C<sup>3</sup> issue.

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Commander-in-Chief, U.S. Naval Forces, Europe

ATTN: N3262, Nuclear Surety Officer

DEPARTMENT OF THE AIR FORCE

Air Force Geophysics Laboratory

ATTN: SULL

Air Force Weapons Laboratory

Air Force Systems Command

ATTN: OYC  
ATTN: SUL

Assistant Chief of Staff

Intelligence

Department of the Air Force

ATTN: INAK

Assistant Chief of Staff

Studies & Analyses

Department of the Air Force

ATTN: AF/SASC  
ATTN: AF/SAGF

Deputy Chief of Staff

Operations Plans and Readiness

Department of the Air Force

ATTN: AFXDXFM  
ATTN: AFXOK

Deputy Chief of Staff

Research, Development, & Acq.

Department of the Air Force

ATTN: AFRDQSM

Electronic Systems Division

Department of the Air Force

ATTN: XRC

Foreign Technology Division

Air Force Systems Command

ATTN: NIIS, Library

Headquarters Space Division

Air Force Systems Command

ATTN: SKA

Headquarters Space Division

Air Force Systems Command

ATTN: YCPC

Strategic Air Command

Department of the Air Force

ATTN: XPFS  
ATTN: NRT  
ATTN: DCXT

DEPARTMENT OF THE AIR FORCE (Continued)

Tactical Air Command

Department of the Air Force

ATTN: DRA

Commander-in-Chief, U.S. Air Forces in Europe

ATTN: DOC  
ATTN: XPXX

Ballistic Missile Office

Air Force Systems Command

ATTN: MRBM

OTHER GOVERNMENT AGENCY

Central Intelligence Agency

ATTN: OSR/SF, R. Virgo  
ATTN: OSR/SEC  
ATTN: OSI/LSD, R. Hart

DEPARTMENT OF DEFENSE CONTRACTORS

BDM Corp.

ATTN: W. Sweeney  
ATTN: Corporate Library  
ATTN: D. Poe  
ATTN: R. Carlin  
ATTN: R. MacOnie  
ATTN: J. Wilson  
ATTN: W. Whang  
ATTN: C. Campbell  
ATTN: A. Reese  
ATTN: T. Julian  
ATTN: P. Dittmer

Boeing Co.

ATTN: R. Scheppe

66th MI Group

ATTN: RDA/Munich

Computer Sciences Corp.

ATTN: Security Officer for H. Blank  
ATTN: Library

ESL, Inc.

ATTN: J. Marshall  
ATTN: Library

General Electric Co.—TEMPO

ATTN: DASIAC

General Electric Co.—TEMPO

ATTN: DASIAC

Institute for Defense Analyses

ATTN: D. Signori  
ATTN: Classified Library

Kaman Sciences Corp.

ATTN: D. Choate

RCA Corp.

ATTN: E. Van Keuren

DEPARTMENT OF DEFENSE CONTRACTORS (Continued)

R & D Associates

ATTN: R. Poll

ATTN: R. Schaefer

ATTN: Technical Information Center

ATTN: R. Latter

ATTN: C. MacDonald

R & D Associates

ATTN: L. Delaney

ATTN: A. Cicolani

DEPARTMENT OF DEFENSE CONTRACTORS (Continued)

SRI International

ATTN: W. Jaye

ATTN: C. Shoens

TRW Defense & Space Sys. Group

ATTN: W. Rowan

TRW Defense & Space Sys. Group

ATTN: J. Dyche